

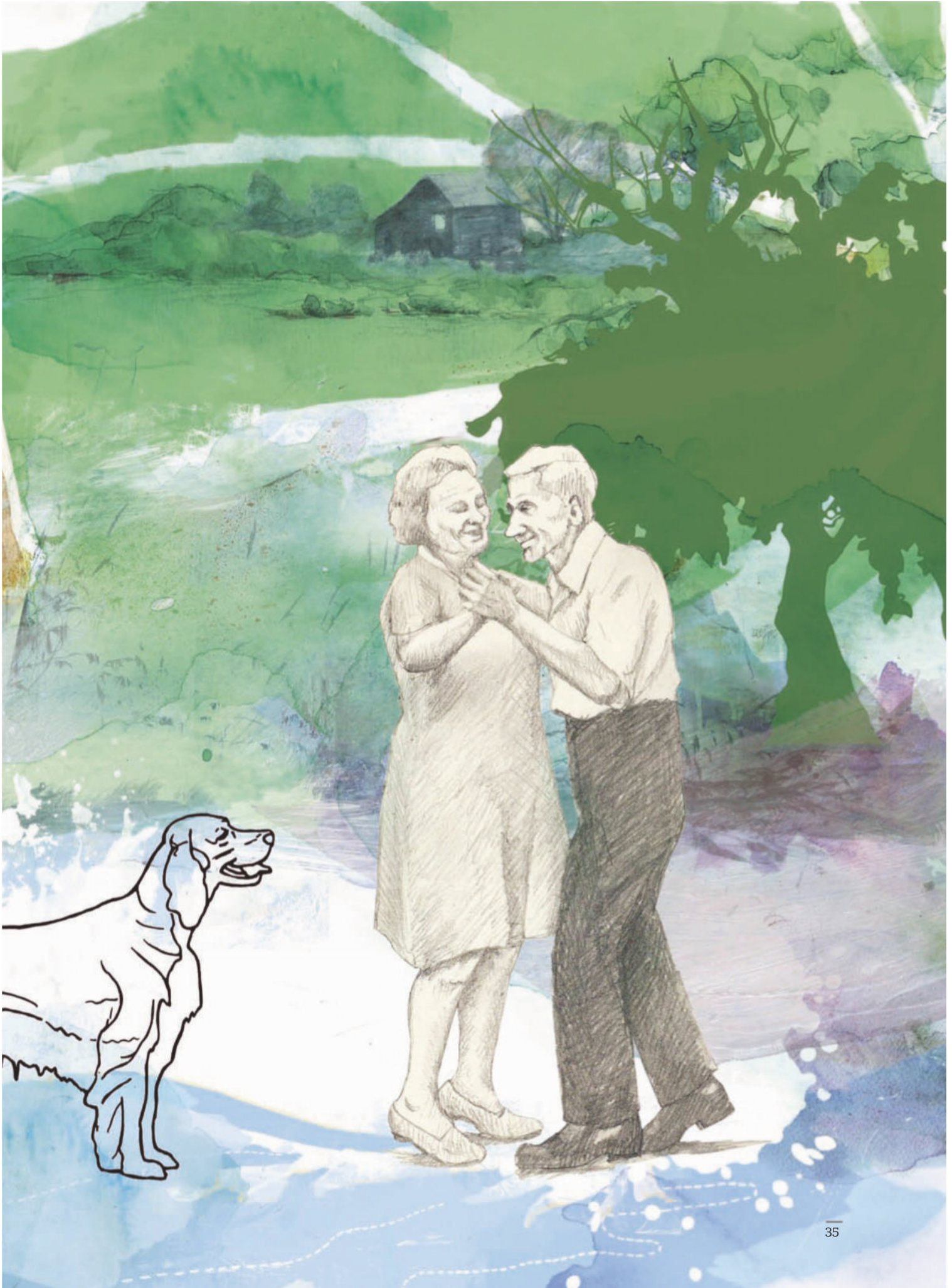


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Why We Forget

Many of us are anxious about losing our memories, but letting go of certain information allows us to store what is important.









FORGETTING CHILDHOOD



Our memories shape and define us. So why do our earliest experiences start to fade when we are just 3 years old?

By Patrick Rogers

I'D LIKE TO SHARE AN EPISODE FROM MY early youth, a minor medical emergency, quickly resolved. I was a healthy child and on schedule with regard to all developmental milestones when, sometime before my second birthday, I began to experience sharp pain in my ears. I shrieked in my crib and clawed at my ears with my hands. Multiple trips to the pediatrician did nothing for the pain until I was admitted to the local hospital, where a surgeon performed a simple procedure to alleviate the pressure behind my eardrums. I was cured. Still, my mother recalls holding me in her arms all night long, so worried was she about her youngest child.

I, on the other hand, remember nothing. The details of this childhood trauma, in addition to everything that happened in the two years that preceded it and all of the events of my life in the 12

months or so that followed, are completely lost to me. In fact, I remember nothing until my family moved the following year to another town, where a neighbor's cat wandered into our yard and sat beneath a shrub. That is my indelible, and rather mundane, first memory. But before that, the sights and smells, the taste of favorite foods, the birthday presents and bug bites of my early youth—all are completely gone.

Scientists have a name for this: childhood amnesia. As infants, even without the language skills to describe them, we can store away information in our brains and then retrieve it for later use. Yet beginning at the age of about 3½ years, the memory chips of the human mind begin to experience failure. Our childhood recollections start to fade, and by the age of 7, they are almost entirely erased, so that a teenager recalls no more of her earliest years than a 50-year-old woman does.

It's no surprise that we retain some facts and experiences but forget the others. "The first thing that we have to accept is that most of our memories don't last, and that's true across our lifetime," says Robyn Fivush, a professor of psychology at Emory University who studies autobiographical memory. "Are they completely forgotten? That's kind of controversial because how do you say they can never, ever be remembered again? But certainly they become very, very difficult to access."

To the average observer, the timing of this accelerated loss of data during the pre-school years is also confounding. It is the very time of life when the brain develops rapidly in both size and complexity. Its weight jumps from 25% of adult size at birth to 75% by age 2, suggesting more room for memory and cognitive power. Yet the brain's development is uneven: most of the cells of the hippocampus, the center of memory and emotion in the brain, are formed before we are born, for instance, while the area that joins the hippocampus to the brain's cortex, the dentate gyrus, doesn't mature until after the first year of age. In the prefrontal cortex, another of the brain's memory makers, the density of synapses (the specialized connectors that allow the

brain's messages to circulate) surges between eight and 24 months.

A young person's brain is not fully mature, with all of its memory components working in tandem, until the mid-20s. What happens in the years leading up to that point? Neuroscientists have proposed that synapses formed in that early, busiest period of development may be overwritten by fresh neural connections, essentially creating a blank slate for the fully forming human brain to populate with a lifetime of new recollections. Other theories focus on the lack of language and immature cognitive skills as reasons that the pre-3 set can't seem to hold on to their thoughts and feelings into adulthood.

THE EPISODES OF our lives—our autobiographical memories—are what shape our sense of self and define us. Although the literature includes many examples of adults who do have precocious memories of events like the birth of a sibling, these sequences of personal history are largely elusive, which makes childhood amnesia, a condition that is considered universal, so compelling to study today. "Knowing how autobiographical memory develops is critically important to understanding ourselves as psychic beings," wrote psychologist Patricia Bauer of Emory University in a 2014 study that plotted the onset of

childhood amnesia. "Remembering yourself in the past is how you know who you are today."

People have grappled with the puzzling void of early youth for centuries. Swiss philosopher Jean-Jacques Rousseau observed in the 1700s that children lack "true memory," and the Russian novelist Leo Tolstoy more than a century later sought to reconcile the period of his life he did not remember with his sure knowledge that it had existed. "It is a strange and awful thought that from my birth to the age of three, during which time I was suckled, I began to crawl, to walk, and to speak," Tolstoy wrote in his essay "First Recollections." "Yet in spite of all my efforts I cannot find anything to remember except the two facts of swaddling and bathing. When did my existence commence?"

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For a trial of infants' long-term memory, 1-year-olds were tested in an unusual environment and an ordinary room.

When the father of psychiatry, Sigmund Freud, coined the term “childhood amnesia” in 1905, he described it as a self-defense mechanism that cast “a veil” of forgetfulness over disturbing sexual and Oedipal memories. Contemporary researchers have taken a more expansive view of childhood amnesia—we lose more than just lusty memories, after all—and focused on language and the physical development of the brain when examining the inability of young children to form an autobiographical account of their lives.

When we look back at distant memories, they tend to be fragmentary and vague and are frequently laden with emotions. Even when we recall a vividly detailed flash of awareness, like a grandmother’s polka-dot dress, the background and context are indistinct. In real time, however, infants and toddlers

probably experience sharp and detailed recall. They have the capacity for short-term memory, which allows them to repeat simple sequences like drinking from a bottle, as well as the type of long-term memory that scientists call declarative or semantic, which includes knowledge of facts.

Young children don’t need words to convince us that they can remember: just ask a proud parent whether the face of their infant lights up every time they walk in the room, or note how a baby may become fussy in the doctor’s office waiting room, suggesting unpleasant associations with the place. Proof that pre-linguistic children have memories independent of physical cues has arrived only relatively recently. In a landmark study published by Emory’s Fivush in 1987, children as young as 2½ years old were observed reaching back into their

pasts to pluck out events that had occurred up to six months earlier, including one little boy who recollected taking a glass ornament from the Christmas tree that broke and cut his hand.

“That sounds like a very elaborate narrative, but what he actually said was ‘ball’ and ‘cut’ or something along those lines. It took the adult to say, ‘What ball?’ and ‘Did it break?’” says Fivush, who believes that the memories that stay with us from early childhood are those that have been integrated into our autobiographies. “Did the boy have a memory of this event? Yes. Was he able to put it into a more coherent narrative structure that may allow him to remember it for longer? No.”

In a subsequent research paper in the U.K., 12-month-old babies were shown how to play with a set of toys without being allowed to actually touch them. When the infants were tested again four weeks later, half of them retained the know-how to play with the toys. If people in the past theorized that childhood amnesia occurs because babies don’t have the words and sophisticated cognitive power needed to form memories, it’s now evident that even pre-verbal infants can encode, store and recall lasting memories, just not permanent ones.

Less is known about why the library of the young mind rapidly depletes itself at about the same time children start school. When Emory University’s Bauer and her team set out to probe the dynamics of childhood amnesia in 2013, they recruited more than 80 3-year-olds in Minnesota. The toddlers were questioned by their own mothers about six recent events—camping, birthday parties, visits to relatives—as researchers looked on. The children then returned to the lab years later at specific ages, from 5 to 9, to have their memories tested again.

On their second visits, children between the ages of 5 and 7 could still recall about two thirds to three quarters of what they had remembered at age 3, yet by age 8 or 9 they could summon only about a third of their early recollections. As seen before, the young subjects were robust memory makers, forming strong recollections that lasted for up

to four years. But then they experienced a die-off of memories after the age of 7 that would be considered catastrophic in adults. Bauer has proposed that early-childhood memory is a two-sided coin in which forgetting is just as important as remembering: “Indeed, it is the apparently ‘off the charts’ rate of forgetting that makes the phenomenon so mysterious,” she wrote in the American Psychological Association’s Psychological Science Agenda in 2004.

WHAT, THEN, MAKES us forget? Underneath the cranium, neuroscientists are looking at the physical building blocks of human recollection, the electrically excitable neurons that join together to form synapses. In the hippocampus, these new cells are constantly generated in one area, the den-

tate gyrus, and then migrate to another, the granule cell layer, where they join the existing circuitry. In studies of mice, researchers artificially sped up neuron production in this part of the brain. But in accompanying memory tests, the mice showed a higher rate of forgetfulness as memory capacity was physically growing. The researchers from Toronto’s Hospital for Sick Kids hypothesized that their brains were remodeling at a rapid rate, just as humans do in early childhood, and shedding existing memory in the process. Out with the old, in with the new.

Bauer’s study of childhood forgetting in 2014 also provided clues about the critical role that language may play in determining which bits of information make the jump from short-term to long-term memory and which are left to oblivion. Children whose parents encouraged them to elaborate on their recollections by saying “Tell me more” or “What happened?” had richer recall later compared with those whose parents confirmed or repeated their replies. The act of pondering and articulating the facts of our lives, of rehearsing our own autobiographies, appeared to mark certain facts and experience as candidates for memory consolidation. Units of information that arrive in the brain separately from the sensory organs are woven together into multifaceted memories that are harder to forget—the memory skill that the little boy with the



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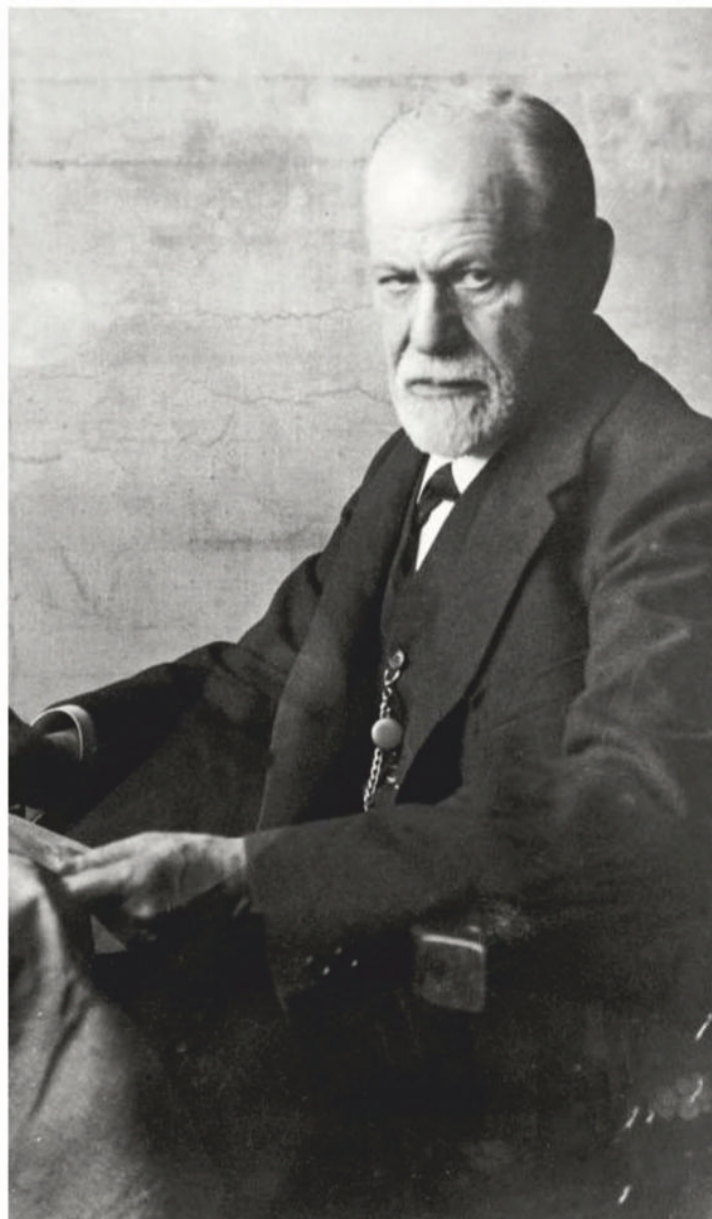
Christmas ornament hadn't yet mastered.

Language also plays a role in the generation of false memories from childhood, specifically when other people script the stories. The Swiss psychologist Jean Piaget famously insisted that his first memory was of his nurse fending off a kidnapping attempt on the Champs-Élysées when he was still in the pram. When Piaget was 15, the nurse admitted she had invented the story, and even then he could still picture the scene in detail.

This type of “memory of a memory” occurs often. It's not unusual, for instance, for siblings to argue over which one was the girl who flew head-first from a swing at a family picnic and landed in a puddle while wearing her favorite dress. In a 2018 survey of more than 6,000 adults in the U.K., most reported their first memory, predictably, in the first half of the third year of life—which is when researchers have shown that first memories usually fall. Those who departed from the norm tended to veer on the young side, with nearly 2,500 (about 40%!) reporting memories from before the age of 2. Almost 15% said they could recall events from age 1 and earlier—a “highly improbable” occurrence, according to the study's authors from the departments of psychology of three British universities.

As an explanation of their unexpected findings, the U.K. psychologists proposed that people take imagery from photographs, home videos and childhood events and combine them with a fragment of visual information. “Over time, this combination of imagery and fact begins to be experienced as a memory,” wrote lead author Lucy Justice on the website *The Conversation*. “Perhaps, for reasons not yet known, we have a psychological need to fictionalize memories from times of our lives that we are unable to remember. For now, these ‘stories’ remain a mystery.”

A mystery, perhaps, but not really a surprise. We wouldn't have *Ancestry.com* and write memoirs if we didn't feel a strong impulse to fill in the facts of our beginnings. For every person who tries to fill the lapses of early childhood with invented or borrowed memories, there are others who have no such memories and worry there's something wrong with them. There's not. “Our experiences, all of our experiences, impact our bodies and our brains, whether we remember them or not,” says Fivush, who recalls a subject in a memory study who swallowed a chicken bone at the age of perhaps 14 months and



Psychoanalyst Sigmund Freud, here in 1926, believed childhood amnesia was caused by the repression of traumatic, psychosexual memories.

was taken to the ER. Though the girl had no recollection of the incident later, she became hysterically frightened whenever her parents served chicken for dinner. “We can say, ‘I have no idea why I'm like this,’ says Fivush, “but you look in the medical record, or family history, and there it is.” □



*Meck, second from right,
posed with her brother Rob,
mother, and sisters Diane and
Barb on Easter day, 1968.*



A LIFE LOST TO AMNESIA

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Su Meck was just 22 in 1988 when a ceiling fan fell on her head, wiping away her memory and personality. She began her second life in a house she didn't know, with a family she didn't recognize

*By Su Meck with
Daniel de Visé*

After being in the hospital for only three weeks, I was released to go home. That in itself was a small miracle, because my husband, Jim, was initially told that with injuries such as mine, it wasn't unusual for people to stay hospitalized for eight months, maybe longer. But medically speaking, my MRI scans did not show the doctors any kind of persistent or residual damage to my brain. So in their opinion, I was all better. In the words and spirit of those evangelical preachers, "I was healed!" The rehabilitation staff told Jim, "Our goal is to get someone who is 5 to 15 percent functional to 20 to 30 percent." Jim was told that I was quite possibly at 70 or 80 percent. I was the valedictorian of head injury patients.

The hospital records present my release as if it was a matter of mutual agreement. That is how Jim remembers it. But in hindsight, my discharge seems rather abrupt, certainly considering that three days earlier, a neuropsychologist had described me as moderately to severely impaired in five major cognitive areas.

"I remember Jim kept saying, 'We've got to get her out of the hospital, because they keep dropping her on her head,'" my sister Barb recalls.

My mom: "I do think you should have been in the hospital longer than you were."

Here are a few of my own thoughts about all of this now: Jim was driving everyone crazy at the hospital with his demands. He didn't know what to do with our young sons Benjamin and Patrick, he had to go to work and he had run out of, or used up, all his options for babysitting. I think I was somehow "fast-tracked" out of the hospital, either because of Jim's behavior or our medical insurance coverage. All of a sudden, people started writing in my chart that my problem was most likely something psychological rather than physical, and

I was shown the door.

To this day Barb tells me, "You were not ready. You should have gone to a rehab facility, or you should have gone home with a crew of therapists; someone to help you with speech, a therapist to help with gross motor skills, and an occupational therapist to help with fine-motor tasks. You couldn't write. Walking and moving around was hard for you. You couldn't even use your left side, and you were left-handed!"

Let's think about this for a second, shall we? And part of this will just be me speculating, of course. Did I know who I was? After three weeks in the hospital? I probably knew my name was Su Meck. Did I know Jim, Benjamin, and Patrick? Did I understand husband? Marriage? Son? Brother? Mother? Father? My guess is no, I didn't. I

probably didn't have a clue as to how to take care of myself, let alone two very young boys. Was leaving the hospital really a safe, smart, logical next step? Looking back, I don't think it was safe, smart, or logical. And yet, that is exactly what happened.

Whatever the reason, I was released and taken to live in a house I did not remember. The 1970s gold-flecked linoleum and shag carpeting, the green scratchy couch, the brown kitchen cupboards, the large backyard surrounded by a privacy fence: None of these things registered with me. Jim remembers me walking hesitantly down the hallway that led from the family room back to the bedrooms. He recalls me just staring at all of the family photographs that were hanging there. "That's me!" I said, pointing to my image. "And that's me, too!" I recognized myself in the more recent photographs, but I had no recollection of the places where even a single one of the pictures had been taken, or any of the stories behind them. I was not able to identify any of the other people—other friends and family—in the photos. It was sort of like being airbrushed into a life. A real-life Twilight Zone.

Excerpted from the book I Forgot to Remember: A Memoir of Amnesia by Su Meck with Daniel de Visé. Copyright © 2014 by Susan E. Meck. Reprinted by permission of Simon & Schuster, Inc.



Meck and her husband, Jim, in Texas, in the spring of 1986. At the time, she was pregnant with their first child, Benjamin.

I walked into the kitchen and opened every single cupboard and drawer. There was nothing recognizable about any of this stuff. I probably didn't even know what most of the items were called, or what they could possibly be used for. The hospital was all I knew. Everything in this house was unfamiliar, and I can only imagine how bewildering and daunting that unfamiliarity would have been to me. What would it have felt like for me to not know even the names of objects in my own home? But then I think, did I even care?

This is another thing I don't remember: after my

accident, when I was still in the hospital, one of the things I was taught how to do was make tuna fish salad. I am sure tuna fish salad was used as a "training food" for food preparation and kitchen safety purposes because there are a lot of different steps in preparing tuna fish, as well as a lot of learning how to use kitchen tools. I was taught everything from operating a can opener, to safely using a sharp knife and cutting board, to using a measuring cup, to stirring all the ingredients together with a spoon in a big bowl, and then to finally manipulating another knife to spread the tuna on bread. I was taught how

to properly wash and peel fruits and vegetables, and even how to boil an egg in a pot of water on the stove.

Armed with this vast expanse of knowledge, I was sent home with the expectation that I would be able to feed my family and myself.

And that is exactly what I did. I fed my family tuna fish. Breakfast. Lunch. Dinner. Did anyone complain? I don't know. Did Jim give the boys other stuff to eat? Did he make himself other stuff to eat? Again, I don't know. Did I attempt to cook or prepare anything else? I seriously doubt it. I had been told that "tuna fish equals meal, and meal is what you eat."

I think Jim probably sensed that I needed help, but he was back at work trying to make up for all the time he had missed. Plus, the neurologists kept telling him that there was nothing wrong with me. Jim's parents offered to pay for a live-in nanny to help with the boys, which might relieve some of my stress. Jim asked around and soon hired a woman. And for a few weeks she did, indeed, keep the boys and me alive, keep the house from burning down, and most likely she prevented several major catastrophes. However, she was a devout Christian, and when she came upon Jim's extensive stash of pornography, she told him she could no longer work in our home.

Suddenly Benjamin, Patrick, and I were on our own once again. I would wake up each morning with no memory of what had occurred the previous day. I recognized Jim and the boys simply because I saw them every day, but I would have no recollection

of what any of us had done the day before, or what the plan was for that new day. Each day the world beyond my front door was an absolute unknown. Jim says that our family was full of *Lord of the Flies* incidents, in that he never knew exactly what he would come home to after work each day. Would I be there with Benjamin and Patrick? Would we

all be gone? Would the boys be playing together in the backyard all by themselves with me nowhere in sight? Would I be there, but have no idea where Benjamin or Patrick were? Would the bathtub be overflowing? Would the oven or stove be on? I am terrified when I think about what that must have been like for the boys and me. I honestly do not know how we all survived those first days, weeks, months, and even years.

My mom wanted desperately to help out somehow, as well as give Jim a break. But my younger brother, Mark, was still living at home and was not yet driving. Mom felt like she couldn't very well

desert him to come to Fort Worth to look after me. Instead it was decided that Jim would drive Benjamin, Patrick, and me to Houston to stay with my parents for a week. My parents now feel incredibly guilty about how little they understood of my new reality. My mom says that all she really knew was that I had this head injury and that I had trouble remembering things. The letters I sent her looked as if a first-grader had written them, "all phonetic misspellings and shaky script on lined paper," but still she and my dad were not overly concerned.



Meck in the hospital with son Benjamin. Her husband brought the bear in an attempt to trigger her memory. Opposite, a letter Meck wrote her grandparents six weeks after the accident.

Dear Gramma and Grampa,

I got your letter today.
Thank you for writing. Maybe
not people write for me but I
write letters to lots of people.

Maybe Jim can read letter
when comes home for work later.

Cannot read very good I cannot
We have film at store for

pictures I sending. One for
Patrick crawling one for me

and Benjamin (look close)
on big slide in park for bike

riding. Long way to climb
up but good slide down.

Sorry cannot come for
Patrick's birth day party
He will be one year old.



Meck, center, with, from left, daughter Cassidy, son Benjamin, husband Jim and son Patrick, in May 2008

It is highly unlikely that I in fact recognized either of my parents when I climbed out of the car in their driveway. But because Jim had prepared me for this particular reunion, I was able to greet them both with a sort of affection and warmth. Even so, my parents say that they noticed immediately how much I had changed. They had known me as the family troublemaker, loud, defiant, and stubborn. Now my personality was completely different. My dad was surprised at how cooperative and friendly I appeared, nothing like the person I had been even a few months earlier.

Mom thinks it likely that I woke up every morning that week in Houston unsure of where I was or why I was there. I must have been terribly confused to be yet again in a new, unfamiliar place, with unfamiliar people. But Mom thinks I would eventually hear the recognizable sounds of Benjamin and Patrick, and then I would slowly find my bearings, and greet my parents as if nothing was amiss.

My dad remembers something peculiar about that visit. I wouldn't enter the backyard, because of the pool, which absolutely petrified me. He and my mom found that surprising, since I had always been

a strong swimmer and loved the water. I had even been a lifeguard as a teenager. Once again, they seemed not to understand the extent of my impairment. Nobody could comprehend that I was a different person, a new person, just observing and learning stuff as I went along. I seriously doubt I even understood my own fear of my parents' pool.

Because I was so deathly afraid of the pool out back, and wouldn't go near it, we usually spent the hottest part of the day with the boys in the second-floor family game room playing with toys that had belonged to us Miller kids years before. One afternoon I walked over to the piano and sat down. It was the same piano that I had learned to play on as a child. I placed my fingers on the keyboard and began playing Scott Joplin's "The Entertainer." Mom says I played it nearly flawlessly from start to finish. From memory. When I was through, I turned to Mom and asked, "What was that? Where did that come from?" Mom told me that "The Entertainer" was a song that I had learned for a recital as a child. I was not able to ever repeat that performance. It was just gone. A kind of doorway had been opened momentarily, and then just as quickly, it was ruthlessly closed.

All that week, I kept asking for Jim several times a day. But when he finally did arrive the following Saturday afternoon, my mom says I had no idea who he was; in fact, I was afraid of him. Jim says he saw in my eyes instantly that I had once again forgotten him. Of course he was upset by that realization, but what could he do? Apparently, I made my younger brother, Mark, come with us on a walk that evening, because I did not want to be alone with this tall, curly-headed stranger.

A few days after returning home to Fort Worth, Jim sat down with me and taught me how to shave my legs. In fact, he taught me (and retaught me again and again and again) most of what I know about personal grooming. Come to think of it, Jim taught me pretty much everything I know about almost everything. Several weeks (or maybe it was months) later, there was even an awkward conver-

sation about sex. I didn't exactly understand when he tried to explain what it meant to be a "mother" to Benjamin and Patrick. And being a "wife" to Jim was even more beyond my comprehension.

I suppose once upon a time, three years before, Jim and I had fallen in love. After the accident, I had no concept of "love." I knew Jim was there, and I quickly became dependent on him, and later became dependent on the boys, but I didn't really know him very well. I didn't know the most basic things about him, like what he enjoyed doing in his spare time, what his favorite foods were, what genre of books he liked to read, what music he liked to listen to, and hundreds of other little details. I don't think I even really cared so much about any of that stuff, either. I wasn't aware that

I was supposed to care.

However, Jim somehow still loved me. He still knew me, or at least the "me" I had been, which still looked like me. He knew everything about me; what I liked to do, eat, read, listen to, as well as every other trivial detail.

Jim remembered our love from before the accident, and he missed it. He tells me that when we were back at Ohio Wesleyan, we "went from being friends to being friends-with-benefits and eventually to a committed and exclusive relationship." He talks about how he and I "would finish each other's sentences." He says we were inseparable and "when we were together, we were simply more." And now that particular Su that Jim had known was gone. I was utterly naive not only sexually, but emotionally as well. I just wasn't ready for such adult feelings, and wouldn't be for a few years.

For a long time after Meck's injury, she suffered both retrograde amnesia and anterograde amnesia, the inability to form new memories. She would wake up "lost" in unfamiliar places and even today does not remember the first 22 years of her life. But in 2014, 26 years after her accident, Meck graduated from Smith College and released her memoir, I Forgot to Remember. Today, she speaks to survivors of traumatic brain injury and continues to write. □



During the week I visited my parents in Houston, I kept asking for my husband, Jim. But when he finally arrived, I had no idea who he was.



MEMORABLE MOVIES



Amnesia has been a frequent Hollywood topic since the talkies. Do they get it right?

By Emily Joshu

In the new film *Welcome to Marwen*, Steve Carell's character forgets his early life after being beaten by thugs. The theme of memory loss is a Hollywood favorite because it is so relatable, but many movies gloss over the hard science, says Boston neuroscientist Steve Ramirez. "Most people with amnesia aren't Matt Damon going on these super CIA spy scenarios," he adds.

1 / BOURNE, THE SERIES (2002–2016)

Former spy Jason Bourne awakes on a boat with amnesia, two bullet holes in his back and one key to his identity—the account number to a safe deposit box. On the upside, Bourne can still fight, shoot a gun and drive. Retaining these motor memories can be typical for amnesiacs, says Ramirez. "You remember how to walk. You remember how to breathe."

2 / SPELLBOUND (1945)

A new convert to psychoanalysis, producer David O. Selznick wanted to spread the word about therapy and worked with Alfred Hitchcock on this thriller. In it, Ingrid Bergman plays a shrink who helps her colleague and love interest, Gregory Peck, overcome amnesia. Today, some critics dismiss *Spellbound's* portrayal of therapy as muddled.

3 / ETERNAL SUNSHINE OF THE SPOTLESS MIND (2004)

In *Eternal Sunshine of the Spotless Mind*, former lovers try to forget their relationship by having their memories erased. What scientists





find misleading is the portrayal of memories as localized, says Ramirez: “Many now think memory requires a kind of symphony across the brain for it to materialize rather than living in this one corner.”

4 / THE VOW (2012)

An example of amnesia trivialized, with the twist that the plot is based on an actual couple. Kim and Krickitt Carpenter were newlyweds when a car accident robbed Krickitt of her memories of Kim. In the movie, the wife character attempts to reconnect with her husband. Reviewer Roger Ebert criticized the film for not addressing the difficulty of loving someone you can’t remember. “One can imagine the anguish of the case in real life,” wrote Ebert.



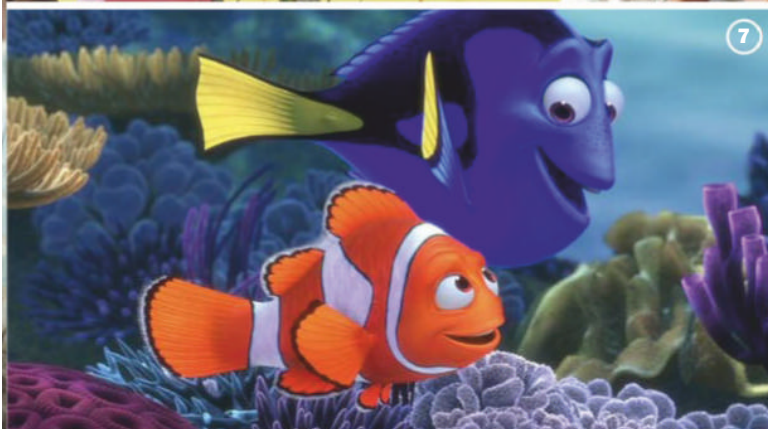
5 / MEMENTO (2000)

After sustaining a head injury in an attack that kills his wife, a man played by Guy Pearce is unable to form new memories. But determined to solve the murder, Pearce tattoos clues on his body. *Memento*’s narrative is told in two story lines, one moving forward in time and one backward, which captures an amnesiac’s fractured identity, says Ramirez.



6 / 50 FIRST DATES (2004)

This rom-com, for many scientists, is one of the worst offenders in terms of misrepresenting amnesia. In it, Adam Sandler doggedly courts Drew Barrymore, even though she wakes every morning having forgotten the day before. “Sometimes Hollywood romanticizes [amnesia] to the point of trivializing it. In reality it changes us to our core,” says Ramirez.



7 / FINDING NEMO (2003)

When overprotective clownfish Marlin sets out to find his lost son Nemo, he crosses paths with Dory, a royal-blue tang who wants to help but is hampered by her three-second memory. Contrary to popular belief, fish do not have tiny attention spans. But, says Ramirez, Dory’s amnesia experience would be accurate for a human. He compares her to Pearce’s determined character in *Memento*; neither let their conditions stop them from their goals.

AGING, MEMORY AND MYTHS



Although the ability to recall memories may begin to decline in your 20s, your fact database peaks as late as 70

By Hallie Levine

IT'S EASY TO PANIC IF YOU MISPLACE your car keys or forget a person's name. But the truth is, these types of memory lapses are common and can happen to anyone at any age. "Oftentimes, simply being stressed and multitasking can make you forgetful," explains Gary Small, director of the UCLA Longevity Center. The good news is that dementia isn't a normal part of aging—fewer than 10% of people in America over the age of 65 have the disease, according to a 2017 study published in the medical journal *JAMA*.

Memory loss, of course, is real, and some types of memory—mainly your ability to think quickly and recall information—start to decline as early as your second decade. Episodic memory, which captures the what, where and when of our daily lives (for example, what time a meeting is) can begin to deteriorate starting at about age 30, as do our abilities to process information, hold on to working memory and multitask. But there are ways to work around this. Here, a closer look at some of the myths and realities surrounding aging and memory.

Myth: It's all downhill after age 20. » Although short-term memory peaks in your 20s—and starts to drop at around age 35—crystallized intelligence, or the accumulation of facts and knowledge, peaks in the 60s or as late as 70, according to a Harvard study from 2015. That's very different from what we would have expected to see just 30 years ago, largely

because of baby boomers, who are more likely than their parents to be college-educated, with professional white-collar jobs that involve a lot of thinking. And although younger people may be able to recall things more quickly, older people have an advantage because they're sometimes able to take short cuts. "The older you are, the more likely you are to draw on past experiences or wide social networks to solve a problem," says Small.

Myth: Supplements can help reduce memory loss » Supplements are unlikely to help, period, says Stephen Rao, chair of the Cleveland Clinic Lou Ruvo Center for Brain Health. Consider fish oil, often touted as a memory aide. A 2012 review by the Cochrane Library, a network of health researchers, looked at studies of the use of fish-oil supplements in cognitively healthy older people and saw no improvement. Similarly, a study published in the medical journal *The Lancet Neurology* of almost 3,000 adults over age 70 with memory complaints found that the herb ginkgo biloba didn't reduce rates of developing Alzheimer's compared with those who took a placebo. DHEA supplements seem to fall into the same category. DHEA is a hormone produced by the adrenal glands, and DHEA supplements—often made from yams or soy—have been touted as a new fountain of youth. A Cochrane review of five clinical trials, however, found no proof that the supplements were effective.

What does work: A Mediterranean-style diet—





Yoga instructor Tao Porchon-Lynch is 100 years old.

loaded with fruits, vegetables, potatoes, olive oil, fish, legumes and whole grains—was linked to a 30% to 35% decrease in risk of cognitive impairment in older adults over 50 (with an average age of roughly 68), according to a recent University of California, San Francisco, study.

Reality: Other health conditions raise risk of dementia » High blood pressure, especially in middle age, is associated with a higher risk of dementia later in life, according to the American Heart Association. The main reason for this is that untreated hypertension narrows and blocks arteries everywhere, including your brain. What's more, researchers have recently found that cholesterol triggers the formation of toxic clusters of amyloid-beta protein, a key player in the development of Alzheimer's disease. Another condition, atrial fibrillation, or AFib, which is present in about 9% of people over the age of 65, has also been linked to dementia. If you have any of these conditions, it's crucial to get them under control. People with AFib who take blood-thinning medications such as warfarin cut their risk of dementia by nearly half, according to a 2018 study in the *European Heart Journal*.

It is equally important to get anxiety or depres-

sion diagnosed and treated. Middle-aged individuals who reported moderate to severe anxiety have been shown to be more likely to develop dementia later in life. "We know that anxiety is associated with higher stress-hormone levels, and, in fact, human studies have found that if you inject someone with a stress hormone like cortisol, it causes temporary memory impairment," says Small.

Reality: Exercise can boost memory. » "It's the most important thing you can do to keep your memory sharp and reduce risk of dementia as you age," stresses Rao of the Cleveland Clinic. Rao is currently doing research among people who have an APOE4 allele, which increases risk of later developing Alzheimer's. In comparing the MRIs of the brains of sedentary people and people who exercise at least three times a week, he's found that the hippocampus in the sedentary group decreased over 18 months, while the active individuals' stayed the same. Another study, from 2016, found that the more active older adults were, the larger their hippocampus. It's important not to just exercise regularly but to limit sitting as well, adds Small, who found that adults between 45 and 75 who sat at least three hours a day had substantial thinning of the part of the brain responsible for the formation of new memories. "This thinning is usually a precursor to dementia," notes Small.

Myth: "Brain training" can help preserve your memory » You've probably heard of computerized "brain training" games touted to help older adults stave off cognitive impairment. But a January 2018 article in the *Journal of the American Geriatrics Society* was skeptical. "The problem with brain training is that they only work for the activity you're being specifically trained for—you may be able to recall your shopping list more easily, but it won't help you remember how to get to the supermarket," explains Small. Instead, he advises learning a new language, taking a class or even just reading the newspaper. People who regularly participate in intellectual activities have a significantly lower risk of dementia, according to a Chinese study published in *JAMA Psychiatry* in May 2018. Or become a do-gooder: seniors who volunteer regularly have lower rates of dementia, according to a study published in 2017 in *PLOS One*. □



Give Your Brain a Break

When stress starts to eat at your memory

BY MARKHAM HEID

You spaced on that lunch meeting you said you'd attend, or you forgot a promise you'd made to a friend or that the glasses you are looking for are on the top of your head. Minor memory lapses strike us all from time to time. But if your brain seems increasingly unable to hold on to new information, stress may be to blame.

"There's a lot of evidence to suggest chronic stress can lead to memory impairments," says Jason Radley, an associate professor of brain sciences at the University of Iowa. Radley's research has shown that high or prolonged spikes in the stress hormone cor-

tisol may "prune" the synapses in your brain's prefrontal cortex and hippocampus, which are essential for certain brain functions, including memory. "Stress levels naturally elevate through the process of aging," Radley says. For those who suffer from chronic stress, it seems the cumulative exposure to cortisol over a person's life span may actually erode cognitive function.

In an age when people are expected to multitask at work and in their downtime, there are likely some predictable consequences. Behaviors such as bouncing between email and texts or talking on the phone while trying to cook dinner can disrupt your brain's ability to store new memories, warns David Meyer, a professor of psychology and cognition at the University of Michigan who has studied the impacts of multitasking on memory.

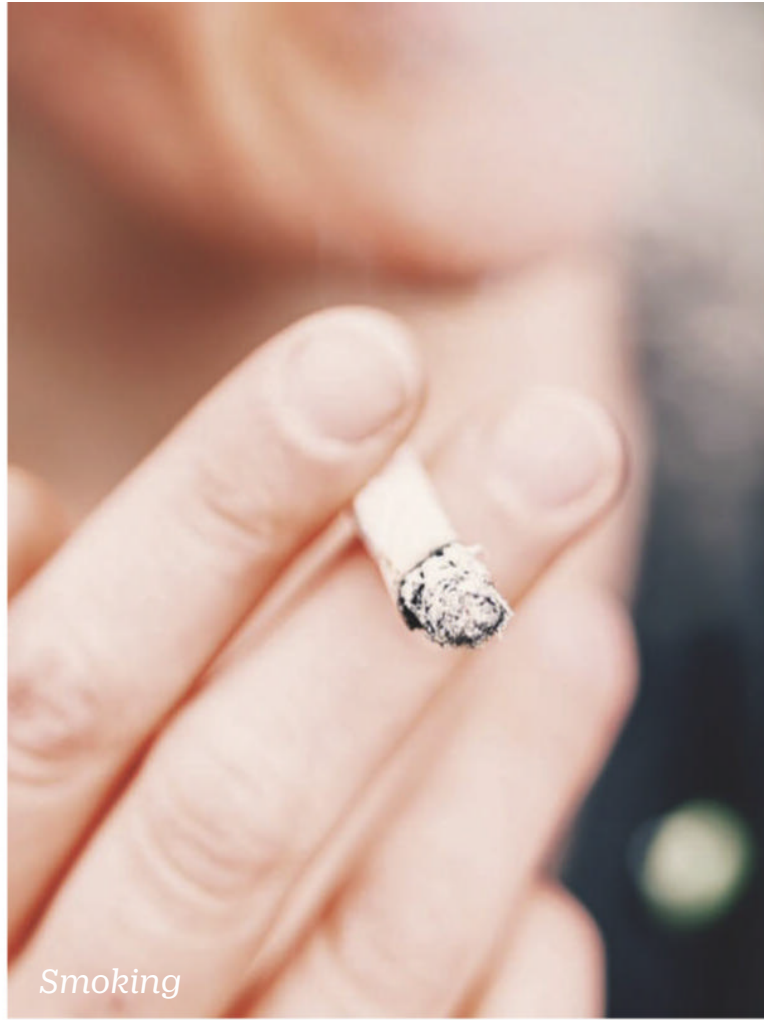
"When you're multitasking, that's interfering with processes that normally would be devoted 100% to doing the mental work that moves info from short-term memory into long-term memory," Meyer explains.

He mentions a well-known experiment during which researchers observed the brain activity of people who were trying to learn new information while multitasking. Compared with a group that was focused solely on learning the new info, the multitaskers had disruptions in the parts of their brain that are used for learning and memory consolidation. On a follow-up test, the multitaskers had higher error rates than their single-focus counterparts, Meyer says.

Your brain needs small breaks after a task in order to lock away new memories. If you're replying to emails while participating in a conference call or chatting with a colleague, Meyer says, your overtasked mind just won't have the chance to store the new information it's collecting.



Depression



Smoking



A high-fat diet



Hot flashes

8 UNEXPECTED THINGS THAT MESS WITH YOUR MEMORY



Put down that doughnut. And that cigarette. And Xanax. They all may be hurting your ability to remember

By Linda Melone

YOU REGULARLY RANSACK THE HOUSE TO FIND YOUR keys. You suddenly can't recall the name of your kid's teacher. You made your six-month dentist appointment three months late. Sound familiar? Fear not: most forgetfulness isn't anything serious, says neurologist and neuroscientist Majid Fotuhi, the medical director of NeuroGrow Brain Fitness Center and the author of *Boost Your Brain*. Lack of sleep, certain medications and even stress may be the culprit. Here are surprising things that impact your memory.

A dysfunctional thyroid

When your thyroid's out of whack, you may feel too hot, too cold, anxious, depressed—and your memory may also be lagging. “Although the thyroid doesn't have a specific role in the brain, memory loss is the one thing a person notices when it stops functioning normally,” says Fotuhi. A butterfly-

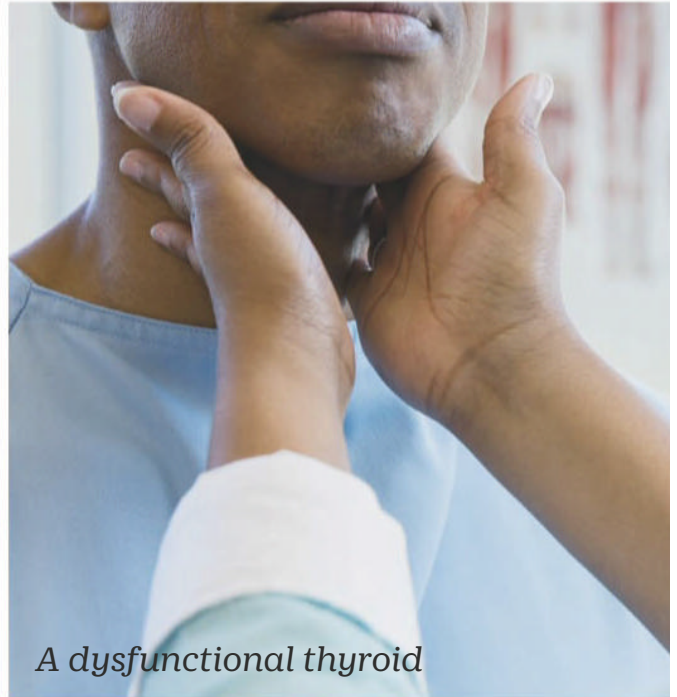
shaped gland that sits along the front of your windpipe, the thyroid reigns over almost all your body's metabolic processes. “People with high or low thyroid levels—which are very common in women—may have difficulty with memory and concentration,” he says. Ask your doctor for a simple thyroid test to determine if it's the culprit behind your memory problems.

Hot flashes

Every time hot flashes make you feel like sticking your head in the freezer, you may also feel a fog rolling into your brain. “The more hot flashes a woman experiences during menopause, the worse her ability to remember names and stories,” says Fotuhi. “Fortunately, hot flashes don't damage the brain in any way. Memory improves once the hot flashes subside.” Other menopause-related symptoms contribute to memory loss, including insomnia and sleep apnea, Fotuhi says.

Depression

Mood disorders may also hinder your memory, several studies show. “We don't understand the

*B12 deficiency**A dysfunctional thyroid*

exact link, but strong evidence indicates depression and bipolar disease disrupt the neural circuitry involved in developing and retrieving memories,” says Allen Towfigh, medical director of New York Neurology & Sleep Medicine. “The severity of the memory loss often mirrors the severity of the mood disorder—severe depression brings about equally severe memory loss.” Prolonged periods of everyday stress increase cortisol levels in the brain, which causes our brain cells to lose synapses (the bridges that connect our brain cells) and makes it more difficult to create and retrieve memories. The good news is that when memory loss exists with a mood disorder, it is usually at least partially reversible. “As the individual’s mood improves, often so does the memory loss,” says Towfigh.

A high-fat diet

Greasy burgers and french fries pack on pounds and are hard on your heart—and they may also cause memory issues. One study revealed that adolescent mice had poorer learning and memory skills after being fed a high-fat diet for eight weeks, while another study on middle-aged rats found that the hippocampus (the part of the brain responsible for short-term memory) may be particularly vulnerable to the impact of high-fat diets.

More research is needed to determine for sure whether high-fat diets impact human memory, but here’s what we do know: Calorically dense diets promote type 2 diabetes, hypertension and cardiovascular disease, which can all do damage to our brains, says Towfigh.

“This holds true earlier in life, too. Studies link childhood obesity with a reduced attention span and impaired concentration and focus.”

Prescription drugs

Check your medicine cabinet: many common prescription drugs can make you feel forgetful. Anxiety-disorder meds such as Xanax, Valium and Ativan (which are benzodiazepines) put a damper on the part of the brain that moves events from short-term to long-term memory. Tricyclic antidepressants have a similar effect. Heart medicines including statins and beta blockers have also been linked to memory issues, as have narcotic painkillers, incontinence drugs, sleep aids and even antihistamines like Benadryl.



Prescription drugs



Germs

Bottom line: don't stop taking your (potentially lifesaving) medications, but talk to your doctor if you believe any drug you are on may be affecting your memory.

Germs

A nasty cold sore does more than make you feel self-conscious—it may be messing with your memory, according to a 2013 study in *Neurology*. Researchers found that people who were exposed to many germs, such as herpes simplex type 1 (the cold-sore virus), over their lifetimes were more likely to have memory problems than those exposed to fewer germs. Among more than 1,600 study participants, those with a higher “infectious burden” had a 25% increase in the risk of a low score on a cogni-

tive test. Although there is no vaccine for the cold-sore virus, childhood vaccinations against other viruses could help prevent problems later in life, the researchers suggest.

A vitamin B12 deficiency

Vegetarians and vegans are at a higher risk of being deficient in vitamin B12, which keeps the body's nerve and blood cells healthy and helps make DNA. That's because B12 occurs naturally only in animal foods. In addition to fatigue, a B12 deficiency can also lead to memory problems. If you are concerned your meatless diet is affecting your memory, ask your doctor for a blood test to determine if you need supplemental B12.

Pregnant women, older adults and anyone with pernicious anemia or gastrointestinal disorders like celiac disease or Crohn's disease may also need supplements.

Smoking

If you're still smoking, that may help explain memory lapses. “Smoking damages the brain by impairing its blood supply,” says Towfigh. Research published in the *Archives of General Psychiatry* gathered from data obtained from more than 7,000 people found a more rapid decline in smokers' brain function (which included vocabulary and other brain functions) with age than in those who never smoked. “Furthermore, cigarette smoking promotes the accumulation of abnormal proteins which impair the brain's ability to process and relay information,” says Towfigh. □